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Impact of Elevated Nitrate on Sulfate-Reducing Bacteria: Implications of inhibitory mechanisms in addition to osmotic stress

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Sulfate-reducing bacteria are studied for their potential in heavy metal bioremediation. However, the occurrence of elevated nitrate in contaminated environments has been shown to inhibit sulfate reduction activity. While the inhibition has been suggested to result from competition with nitrate-reducing bacteria, the possibility of direct inhibition of sulfate reducers by elevated nitrate needs to be explored. Using *Desulfovibrio vulgaris* as a model sulfate-reducing bacterium, it was observed that significant growth inhibition was effected by 70 mM $NaNO_3$ but not 70 mM NaCl, indicating the presence of inhibitory mechanisms in addition to osmotic stress. While the differential expression of a small number of genes in response to nitrate suggested the potential involvement of osmotic and nitrite stress responses, the roles of these two stress responses appear minor given the lack of similarity in the overall transcriptional profiles between nitrate, nitrite, and NaCl stress responses. The presence of unique stress response pathways in nitrate stress is further suggested by the lack of extensive similarities in the response profiles between nitrate stress and various other stress conditions. In addition, the importance of genes with functions in the metabolism of *S*-adenosylmethionine in the shift of energy flow was implicated in nitrate stress response.